DANMARKS OG GRØNLANDS GEOLOGISKE UNDERSØGELSE RAPPORT 1998/99

District Planning in Latvia, Pilot Study in Kuldiga District Documentation on the GIS Part of the Study

Working. Document

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GEOLOGICAL SURVEY OF DENMARK AND GREENLAND
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Table of content

1. Introduction

This working document is prepared as a part of the project "District Planning in Latvia, pilot study in Kuldiga". The project is financed by the Danish Government through the Central and Eastern Europe Environmental Support Fund.

The main purpose of this project is to provide a basis for a coherent district planning in Latvia. This process will inevitably include the production of thematic maps of the planning issues and geographical analysis. In Denmark – and most other European countries - these maps and analysis are today mainly produced by means of Geographic Information Systems (GIS). Thus giving the Latvian district planners the possibility to use the same tools it became a natural part of this project to implement GIS in the Latvian planning process.

This report should be considered as a working document on the establishment of GIS for planning. The main target group is the 26 Latvian districts, especially those which were not involved in this project.

This document describes the GIS related activities which have taken place during the project, evaluating remarks and as a conclusion some guidelines. The described period mentioned here is from April 1997 until July 1998. The outline after this introduction is the following:

- GIS tasks and activities in the project
  Which activities have been completed in the project and which would be recommended in future similar situations.
- Establishing the GIS-workingplaces
  Description of the chosen equipment, software and data to this pilot project.
  What is recommended and what to watch out for.
- GIS-training
  Description of the training sessions inclusive parts of the actual technical content of the sessions.
- Experiences and how to use them in other districts
  Comments on the chosen maps, equipment, backup, continuity, keeping up to date and quality

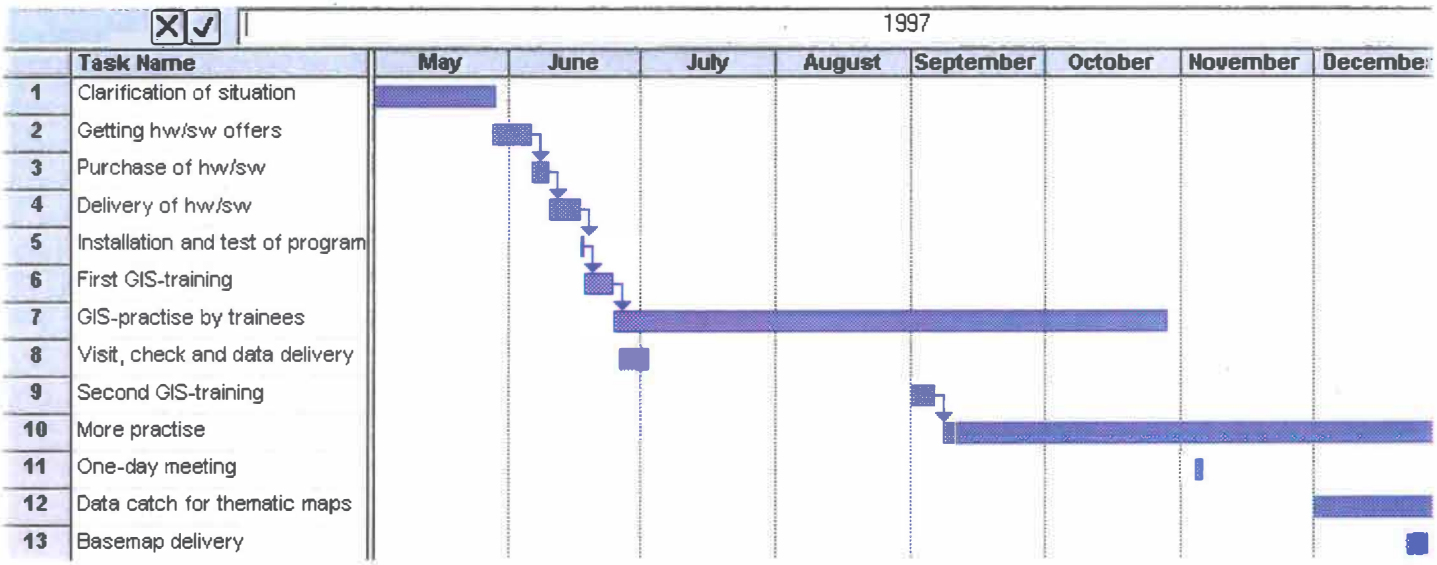
The intention of this paper is to help Latvian district planners who want to include GIS in their planning process. It is not a cookbook but it deals with all the necessary stages in the process and mentions parts of the technical issues too.

Those who are not interested in the GIS-technical matters can skip most of chapter 4 (GIS-training). Conclusions of the experiences will be found in chapter 5, but recommendations are found at the end of every chapter.

2. GIS tasks and activities in the project

The participants in the GIS part of this project were employees in the planning departments in Kuldiga and 4 of its neighbouring districts and planners in the Latvian Ministry of Environmental Protection and Regional Development. The Latvian project co-ordinator Rolands Bruzgulis and two persons from the Latvian Geological Survey participated too. The 4 neighbour districts were involved because we would like to spread out the planning experience to more than one district and because the other districts were in the same stage of development.

While the activities in general in this project have been spread out rather evenly over the project period, the GIS-activities have had some distinct peaks in the first half of the period. To illustrate this a schema of the activities in 1997 is shown here:



In the following the 1997-tasks will be explained:

Task 1: It was initially necessary to clarify the possibilities concerning purchase of hardware, software and digital maps in Latvia. It was also important at this early stage to identify those persons who would participate in solving the GIS-tasks.

Task 2: To be able to select hardware and software to a better quality/price we got 2-4 offers before any delivery.

Task 3,4,5 and 6: The idea was to ensure that all GIS-workingplaces were functioning before the first GIS-training. This would make it possible for the trainees to go on practice immediately after the common GIS-training.

Task 7: The participants were supposed to get experience with ArcView used at local district data as a part-time activity at their usual job.

Task 8: The visit and check in every district had 3 main purposes: 1. to distribute some digital basemaps, 2. to answer questions and 3. to ensure that the GIS-workingplace had no technical problems after being delivered to the districts.

Task 9 and 10: While the first GIS-training gave a common basic understanding of GIS in planning, the second GIS-training were divided into two different sessions: One for coming "GIS-specialists" in the districts and another for the district planners. Some of the content was similar but the GIS-specialists had to learn how to produce new mapthemes for the districts (not just to combine existing maps). The planners learned more about how to make the more advanced geographic analysis well suited to district planning.

Task 11 and 12: A one-day-meeting was held in Kuldiga for 20 persons involved in the project. The main purpose was to start up the general tasks concerning the sector reports, but it became also a follow-up to the GIS-training for the district planners. The first actual production of maps started after this meeting.

Task 13: The official delivery of digital maps from the purchasers to the participating districts and institutions took place in December 1997 and January 1998 after several negotiations and paper works.

In 1998 the tasks concerning mapproduction and getting more GIS-experience continued. Some long-distance consultations were done by phone or e-mail and in week 27 some one-day workshops were held in Riga and Kuldiga practising maptheme production and correction of errors and discussing issues as data quality and consistency.

The intention was to create a personal network among the GIS-users in this project. In this way it should be easy to contact one of the other GIS-users, if minor problems occurs and solve them together instead of expecting the problems solved by external experts. This method is known to increase the general level of GIS-knowledge and the confidence with the procedures. It will also increase the stability of the expertise and make the organisation less dependant on single specialists.

Though the building up of the GIS-user network was included in all meetings and training it is uncertain to which degree the network was used. It is always a task which requires good support in the initial phase, and it is difficult for Danish project partners to follow the situation closely. The lack of tradition for administrative cooperation between the districts might also have caused problems. In future similar situations it is recommendable to put more emphasis on stabilising the expertise through a well functioning GIS-user network.

3. Establishing the GIS-workingplaces

To be able to use GIS in the district planning process all involved institutions will need:

- Hardware – such as computers, printers, plotters, digitisers or scanners.
- Software – operatingsystem, GIS, texthandling, databases and maybe graphical systems.
- Data – digital base maps with topography, planning data and thematic planning maps.
- Expertise – personnel with knowledge about GIS, datahandling and of course the planning issues.

At the beginning of this project the level of these points varied very much from one district to another, but we decided that all participating districts should at least be equipped – by the project - with the same basic GIS-workingplace. Then later they would be supplied with more equipment giving them approximately the same ability to produce maps and GIS-analysis.

The equipment for the GIS-workingplaces were used for the training courses and their functionality was checked again in the participating districts (and the Latvian Geological Survey) a few days after the first GIS-training.

3.1 Hardware

The hardware purchase included at the first stage a Pentium PC with enough computing power and RAM and disk memory to work satisfying with GIS and databases.[1] Every PC had a good quality 17'' monitor, CD-drive and backup facility. All equipment was bought in Latvia after a comparison of prices, quality, guarantees, services and other delivery conditions.

In 1998 more equipment was bought to make the GIS-workingplaces better suited to produce new mapthemes. This hardware consisted mainly of plotters[2], printers, digitising tablet and scanners. Again we got several different offers and chose to buy some equipment from one purchaser and some from others.

3.2 Software

The basic software installed were WindowsNT and Office-97 (with Access database). The chosen GIS became ArcView 3.0a which is one of the most widespread PC-GIS in the world. WindowsNT and Office-97 was bought in Latvia and the price included installation and test at the PCs, while ArcView were bought in Denmark because this was more cost effective. In 1998 an ArcView extension called Analysis was bought via Internet in Sweden.

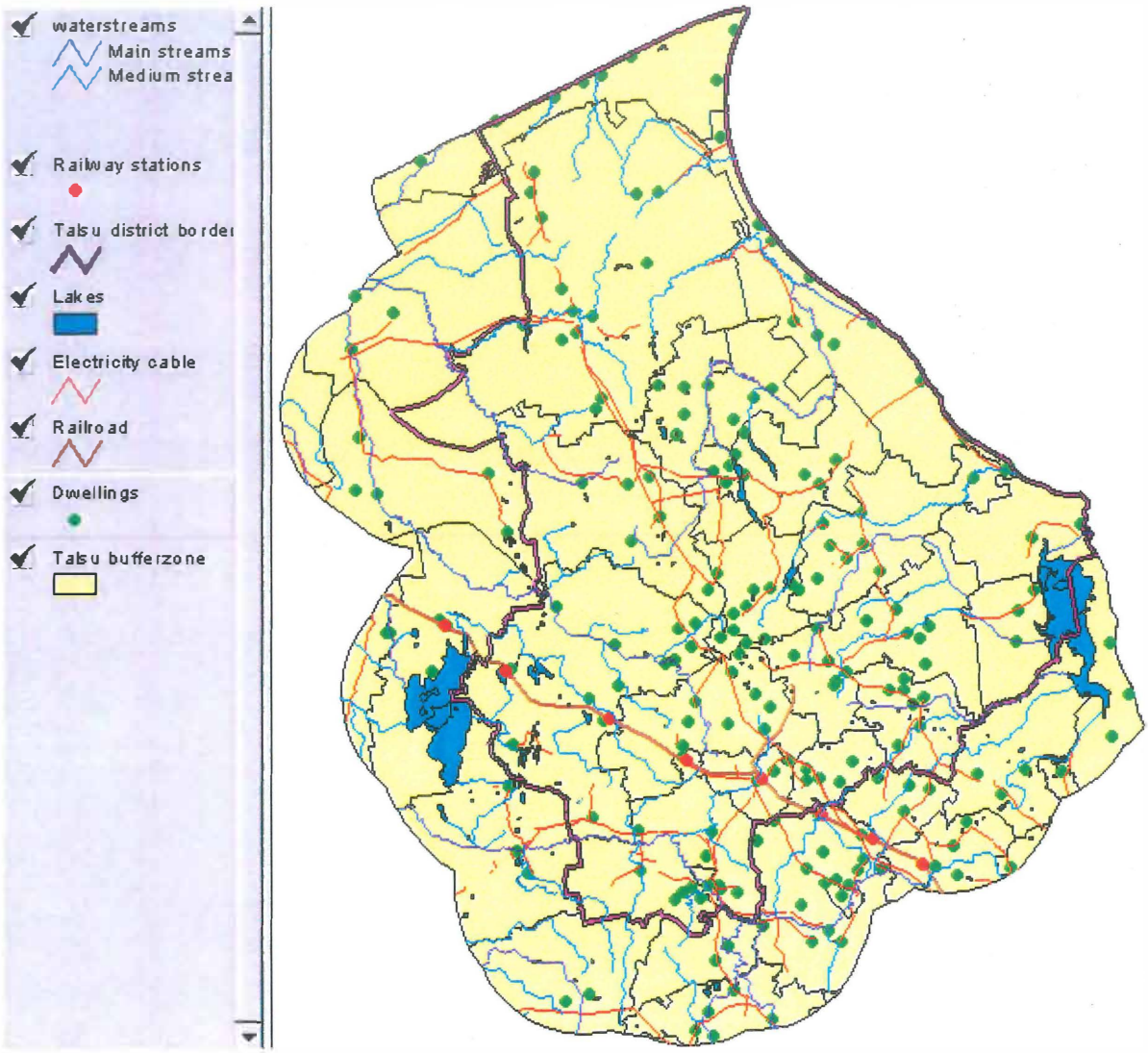
[1] 166 MHz, 64 MB RAM and 2.1 GB disk

[2] same technology as colour inkjet printers but with larger paper formats and more memory

3.3 Purchase of general topographic mapdata

When the project needed digital topographic maps, two possible suppliers were available. The state institution Cartographic Centre and the private company DatorKartor. The Danish district planners normally prefer maps in a scale of 1:100.000 – but maps of this scale did not exist on the Latvian market. The Cartographic Centre could supply maps in scale 1:50.000 and Dator-Kartor produced maps in scale 1:200.000.

To fulfil all needs in the future planning work both sets of mapdata were bought. Every participating district got mapdata for their own territory and a bufferzone around it. (See the bufferzone for Talsu district below).



When we needed the digital maps, they were not quite ready for the relevant districts. Talsu and Saldus had bought maps in 1:50.000 just before this project started but the other districts had to use some preliminary maps 1:200.000 until the final delivery in January 1998. Thus the purchase of digital maps turned out to be more time-consuming than expected.

3.4 Considerations and recommendations concerning the GIS-workingplace

The PCs bought to this project were considered powerful at the time of the purchase, but today one would off course buy a faster CPU well suited to handle the still more demanding software.

The market for computer equipment is expanding very fast in Latvia and both prices, guarantees and delivery conditions are negotiable. We normally took offers from 3-4 different companies before negotiations. The price difference could in some situations be 50-100 %!
The equipment was only paid when it was delivered and tested as well functioning. The only piece of hardware that caused problems was the backup unit[3]. It is however important from the early beginning of using GIS to get used to take backups. The procedure must therefore be reliable and easy.

The operating system to the PCs was at some of the GIS-workingplaces changed to Windows-95 because of problems with plotter drivers or communication with existing equipment. These problems will tend to disappear in the future because both operating systems develop towards a common ancestor, but until then it might cause some troubles which one should demand solved by the purchaser.

As a result of the late delivery of digital topographic maps, the production of new mapthemes to planning purposes was delayed. This led some participants to start using a PC-drawing tool to produce "map-sketches" instead of using ArcView. As a result the maps got no real world coordinates and could not be combined with other data.

To enhance the future production of new mapthemes some ArcView extensions[4] were installed on the GIS-workingplaces. These GIS-programs will make it easier to create and correct digital maps but they also open up for new geographic analysis (see description of Analysis below).

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[3] the Ezflyer drive were too new on the market when we bought it.

[4] Xtools and Analysis

An overview of the Analysis extension

This extension provides ArcView with some extra analysis tools. These tools give ArcView the power to perform advanced analysis that was never possible before.

Some of the tools are:

Buffer	- Buffers selected features.
Distance	-Calculates distances/bearing from features in one theme to features in another theme.
Near	-Calculates the distance/bearing from each feature in one theme to the nearest feature in another theme.
Clip	-Clips one theme using another theme.
EraseCover	-Erases features from one theme using another theme.
Update	-Updates one polygon theme with polygons from another theme.
Dissolve	-Removes borders between polygons that share the same attributes.
Eliminate	- Merges selected polygons with neighboring polygons by dropping the longest shared border between them.
Explode	-Explodes lines or polygons.
Generalize	-Generalizes or cleans lines or polygons.
MapJoin	-Copies shapes from several themes into a new theme.
Split	-Splits one theme into several new themes.
Intersect	-Overlays two themes and preserves only those features that fall within the intersection of the extents of the two themes.
Identity	-Overlays two themes and preserves only those features that fall within the first theme's extent.
Union	-Overlays two polygon themes and preserves all features from both themes.

4. The GIS-training

The GIS-training was carried out as a basic course (in week 25 1997) and a more advanced course (in week 37 1997). The number of participants was approximately 20 in each course, but the education was for both courses held in 2 sessions with 10 trainees because we just had 5 PCs for the training and 2 persons at each PC are a maximum.

Bjørn Hermansen (GEUS) was sole teacher at the first GIS-training, but at the second GIS-training Ole Gregor (Viborg county) and Frants von Platen (GEUS) were assisting. Ole Gregor had emphasis on the GIS and planning aspect while Frants von Platen was teaching the more technical issues such as digitising and editing new mapthemes.

The education language was English but all spoken teaching was translated into Latvian. The English language caused some problems both in answering questions and via the English dialog in ArcView. Nevertheless all the participants were able to produce thematic maps and make basic geographic analysis at the end of the first training course.

All GIS-training took place at the Kuldiga district council. The educational means were the PCs with a printer, a "flip-over" and an overhead projector. At the second course we supplied the equipment with a digitising tablet and a "LCD-device for showing the PC-screen on the overhead".

The materials for the participants consisted of copies of overhead-slides, exercises and the book "Using ArcView GIS". Data for the exercises were mainly Latvian data from Dator-Kartor (the supplier of maps in scale 1:200.000) but especially in the second GIS training some of the data was from Denmark[5] because the needed type of data did not exist in digital form for Latvia yet.[6]

A whiteboard and a "videoprojector" to project screen images to a wall would be a considerable improvement of the education facilities.

4.1 First GIS-training

The training course began with an introduction to the project with emphasis on the GIS-part. Secondly the GIS-trainees got a general but thoroughly explanation of why to use GIS in planning and how to do it. After this an actual GIS-training including exercises in ArcView was performed.

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[5] Planning data sets from Viborg district and geological information from GEUS

[6] Lots of worldwide training data sets were supplied with the ArcView software.

The full disposition for the first course was as follows:

Disposition for 1. GIS-training course

1. Basic introduction
1.1 Presentation of all participants incl. teacher
1.2 Presentation of the project (purpose, content, main tasks)
1.3 Plan for the GIS-part of the project and expectations to this first GIS-training
1.4 Building a GIS-user Network

2. Introduction to GIS and Planning
2.1 What is GIS and which kind of GIS exist?
(GIS-history, explanation of raster vs. vector GIS incl. data types, datastructures, topology, attributes and related data)
2.2 Why use GIS for planning?
2.3 The working processes while handling GIS (incl. data catch)
2.4 Which traps should be avoided?

3. ArcView Basics
3.1 Presentation of the GIS-tool for this project: ArcView 3.0
3.2 The basic concepts of ArcView (projects, views, scripts, layouts, themes, attribute tables, features....)
3.3 Starting up ArcView using existing data (open view, activate, zoom, pan, help)
3.4 Creating a map (add themes, map units, scale, projection, combining themes, datasources, import)

4. Basic Map Manipulations
4.1 Attribute data: Symbolising data (colours) and creation of new attributes
4.2 Making charts (with and without maps)
4.3 Layouts and printing maps
4.4 Putting texts and labels on maps

5. Geographic analysis
5.1 Attributes of features (getting attributes and finding features)
5.2 Geographic search (features near other features)
5.3 Geographic search (features inside polygons)
5.4 Finding intersections between features

To explain the content of the course some of the overheads and screen images, which were used, are shown in the following pages with a short description when necessary (numbers refer to the disposition):

Re 1.2: Presentation of the project
This overhead was used in both 1. and 2. GIS-training to keep some of the goals in mind.

Purpose of the GIS-training

The overall purpose: To think spatially of all planning problems

Purpose of the 1. GIS-training:

- **To realise the value of using GIS in planning**
- **To understand the principles of GIS**
- **To get an impression of the possibilities in ArcView 3.0**
- **To be able to make simple maps with ArcView**
- **To be able to make simple geographic analysis with ArcView**

Purpose of the follow-up in week 27:

- **To check the well functioning of the GIS-workingplaces**
- **To installed (more) basic mapdata**
- **To fill out holes in the basic GIS-knowledge by answering questions**

Purpose of the 2. GIS-training:

- **To be able to produce and evaluate maps for realistic planning**
- **To be able to make geographic analysis of a realistic planning situation**
- **To be able to create and edit local thematic map layers**

Purpose of later sessions:

To customise ArcView and combine it with other tools to solve your problems better and/or easier

Re. 2.1 What is a GIS ?

What is a GIS ?

A Geographical Information System can be defined as a computer system operating with localised data and having the possibility of:

- **Data capture (digitising, scanning, GPS ...)**
- **Storing, maintaining and retrieval of geo-data (localised data, digital maps, DTM...)**
- **Spatial analysis and calculations (overlays, networks, distances, area sizes ...)**
- **Cartographic presentation of user defined maps**

By localised data I refer to any data with a geographic reference - either directly as coordinates or indirectly via county numbers or other ID-codes.

CAD and other programmes for computer graphics is NOT a GIS. - They miss the

Re. 2.2 Why use GIS for regional planning

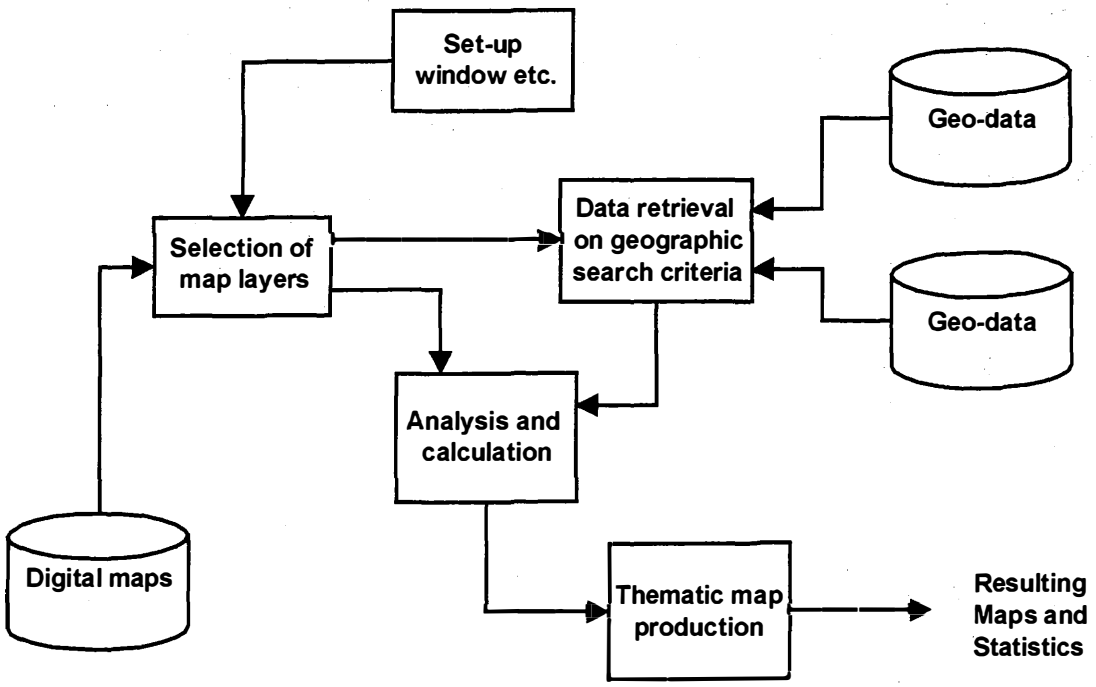
Why use GIS for Regional Planning ?

- **GIS forces you to be distinct and clear in classifications and area definitions**
- **GIS operations are objective, though the basic maps often can be discussed**
- **GIS forces you to think spatially on all topics**
- **GIS makes spatial conflicts obvious and makes it easier to handle the necessary trade-offs**
- **GIS produces thematic maps which are easier to understand for the public than tables and text**
- **The "easy- to-change" maps leave no technical reason not to listen to new proposals. The consequences of new proposals can be mapped easily - maybe instantly !**
- **The end-resulting maps provides a good basis for political and economical decisions**

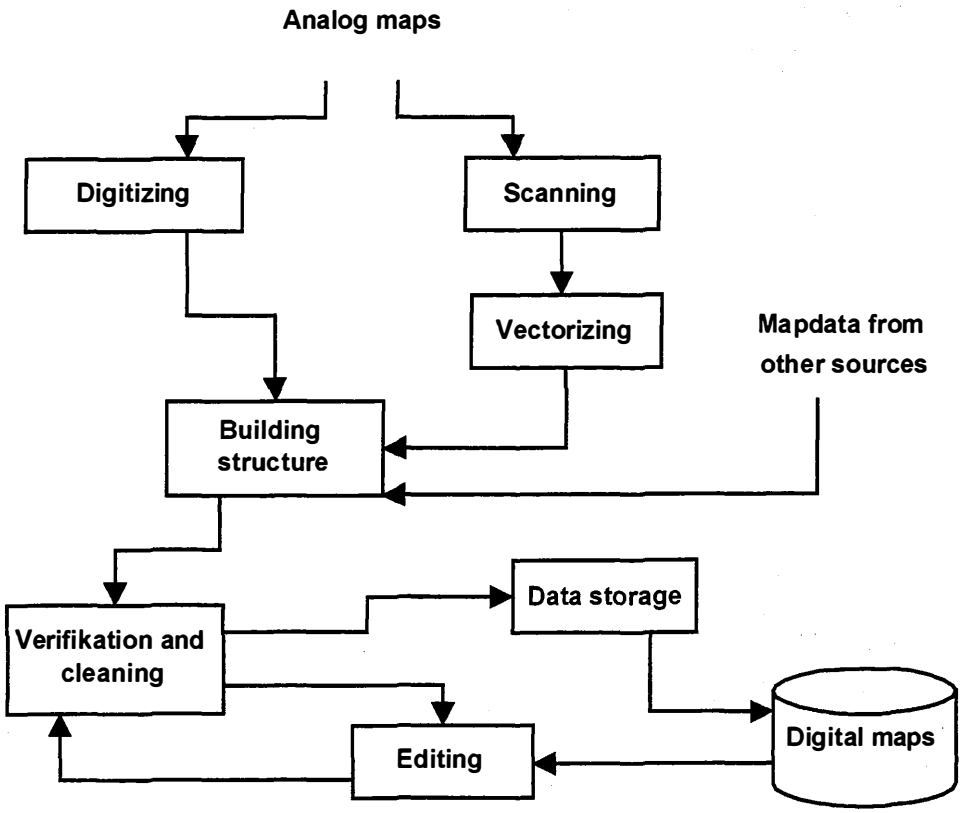
2.3 The working processes while handling GIS

Two overheads were used to explain the way to use digital maps in a GIS respectively how to produce new the mapthemes.

How to use digital maps:

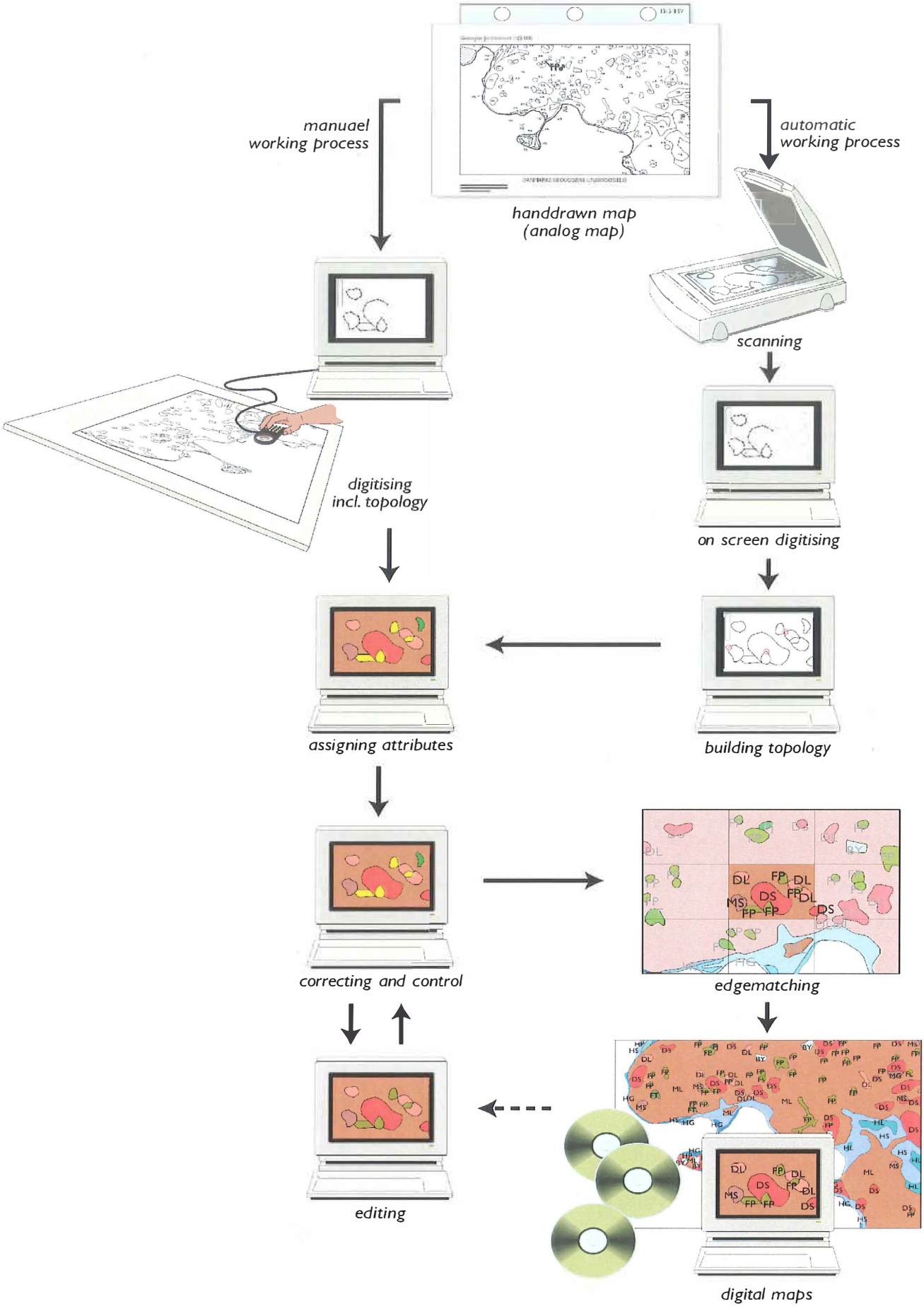


Production of new mapthemes:



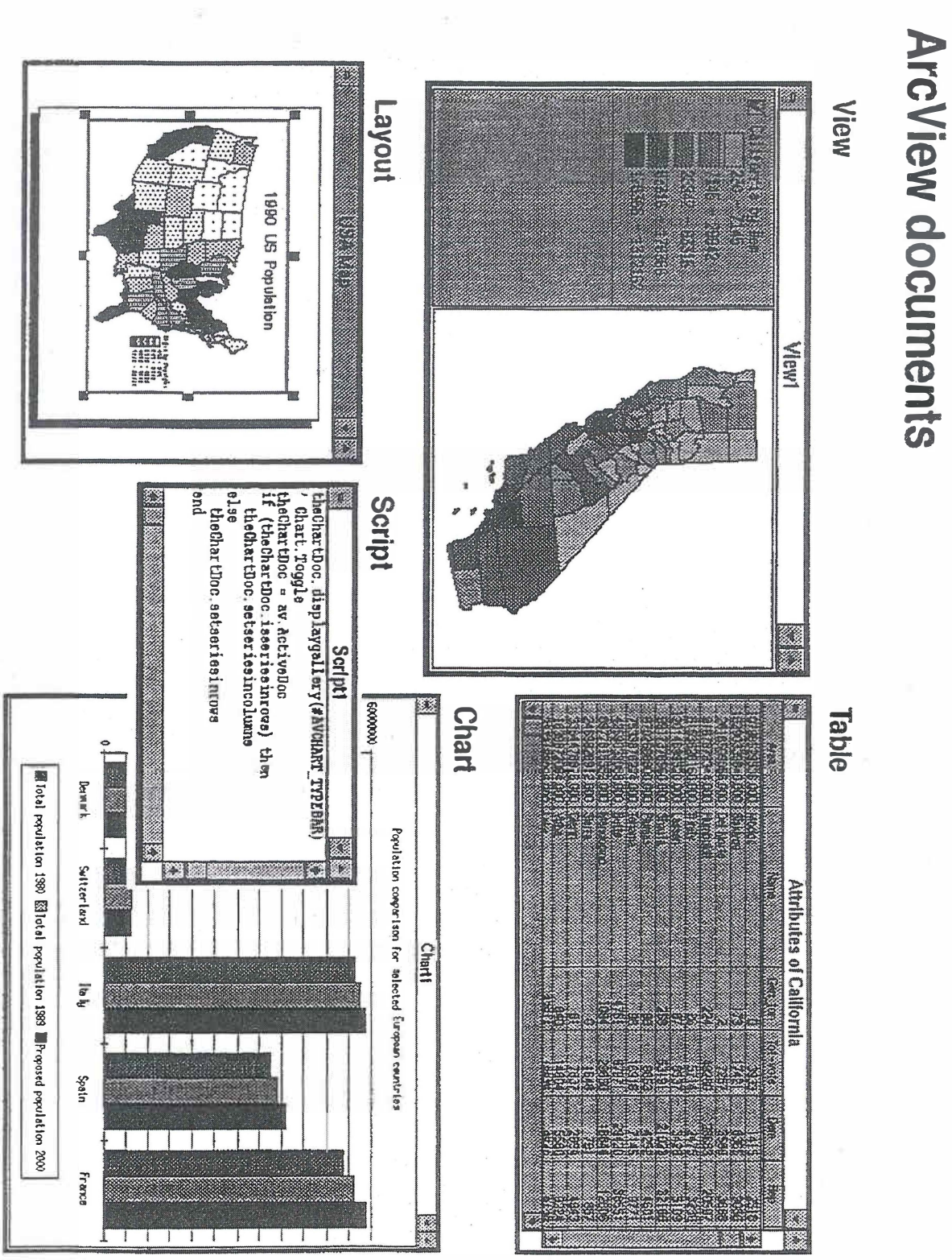
2.3 The working processes while handling GIS

While vectorising a scanned map is not a choice in ArcView, a partly different and less schematic version of the last overhead could look like this:



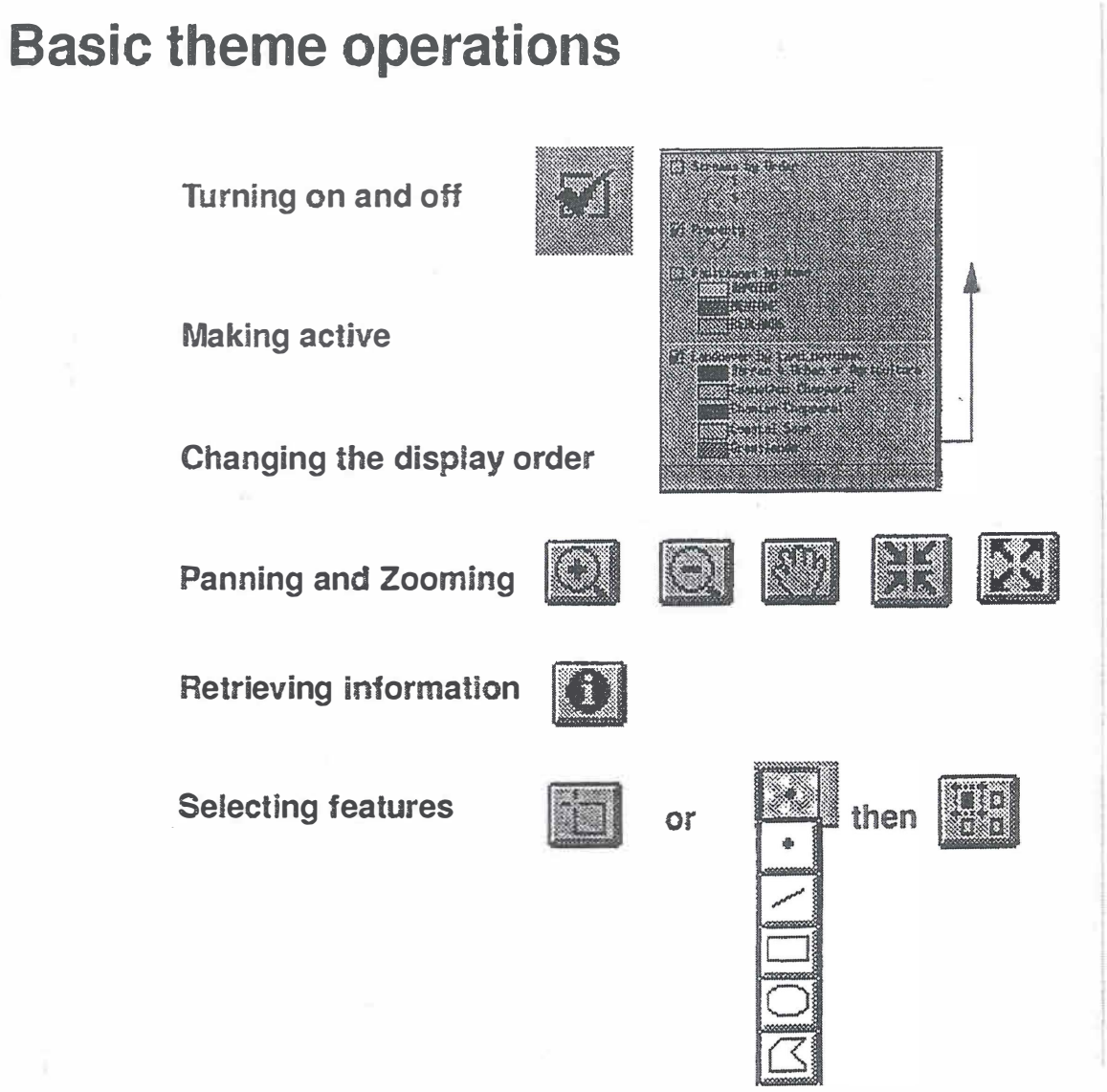
Re. 3.2 ArcView concepts

Five basic concepts in ArcView: A "View" is the composition of maptheme with the user defined appearance. A "Table" is the attribute database attached each maptheme. A "Layout" is a design for a plot. "Scripts" are ArcView programs and "Charts" are diagrams on the basis of calculations and attribute data.



Re 3.3 Starting up ArcView

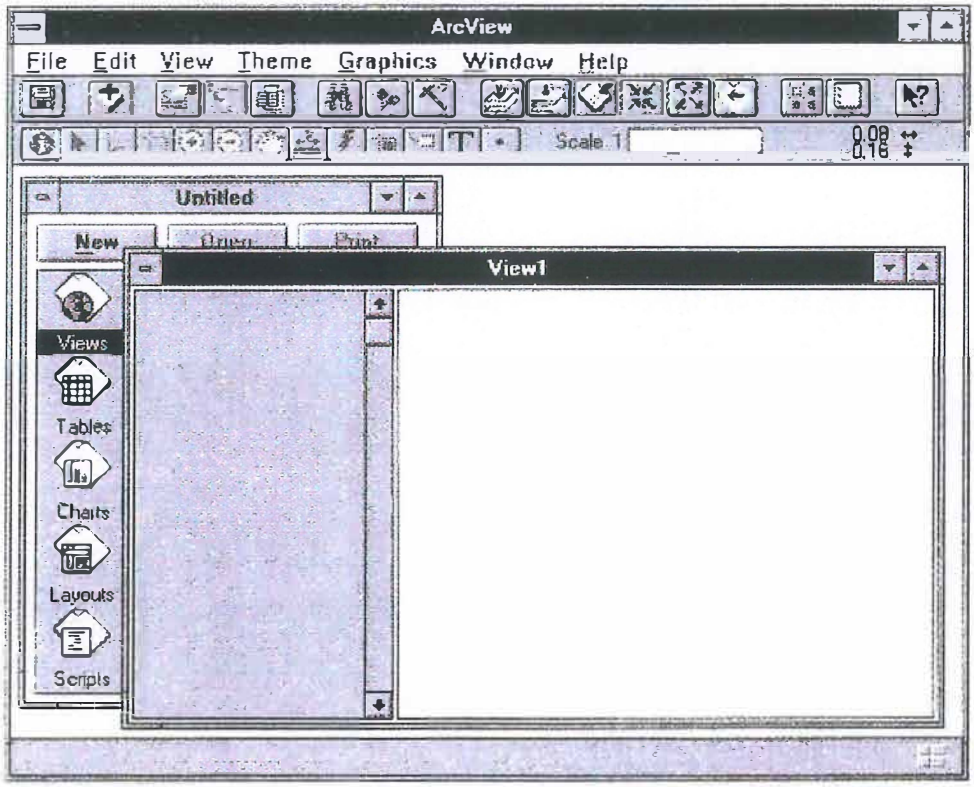
Overheads like the one below were used to explain how to handle "views" to create the wanted appearance of the maps on the screen:



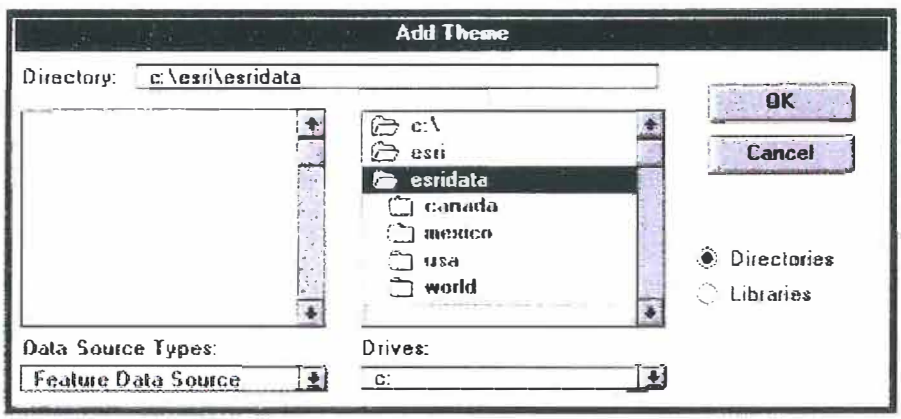
Re 3.4 Creating a map

An example of how the ArcView guidebook (Using ArcView GIS) was used to learn the basic facilities:

1. Start ArcView.
2. In the Project window (the window called "Untitled"), click the New button to create a new, empty view.

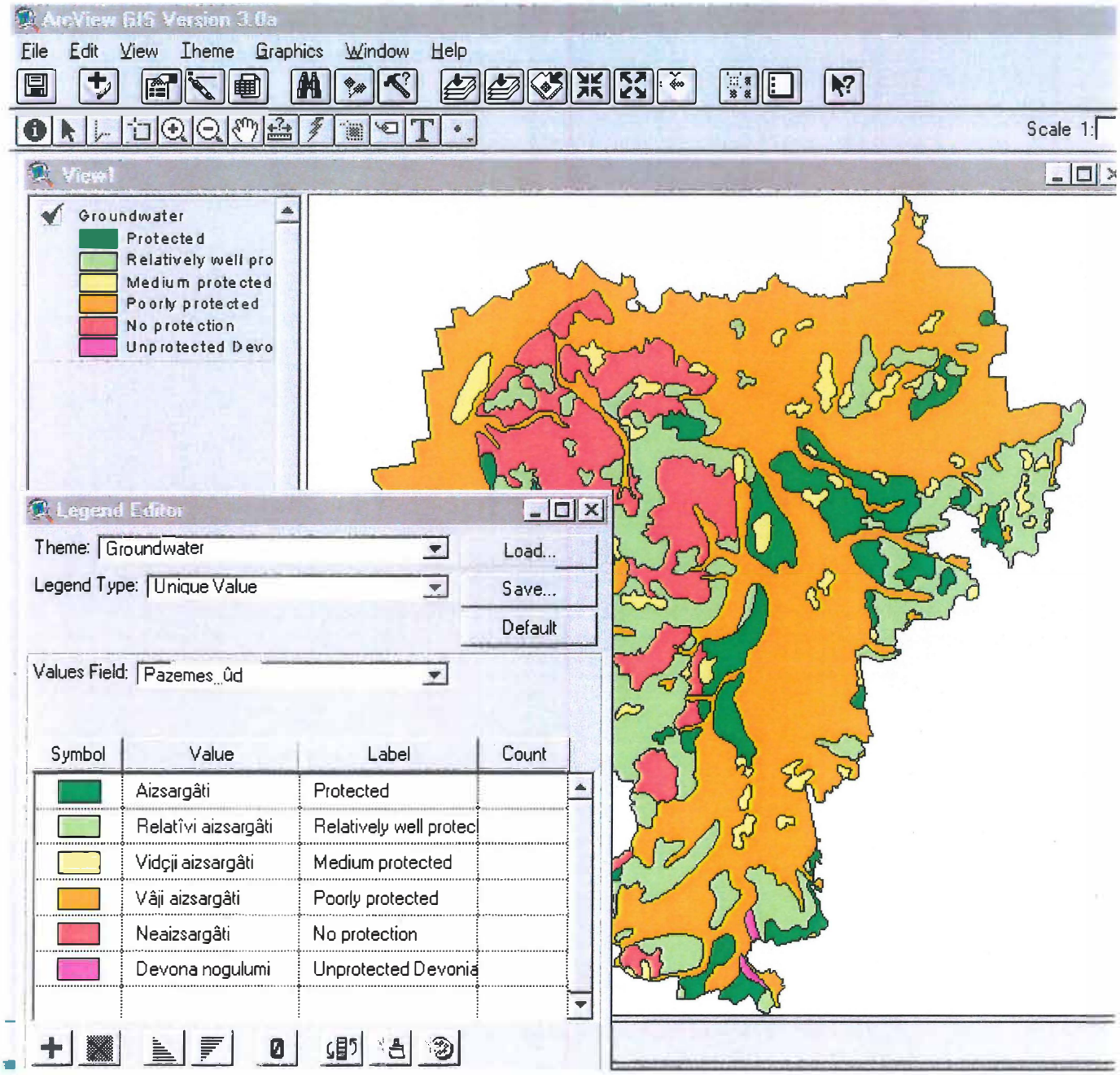


3. Click the Add Theme button. This is the button you use to add spatial data to your map. In the dialog that appears, navigate to the 'esridata' directory. In this directory there are directories containing spatial data for different areas.



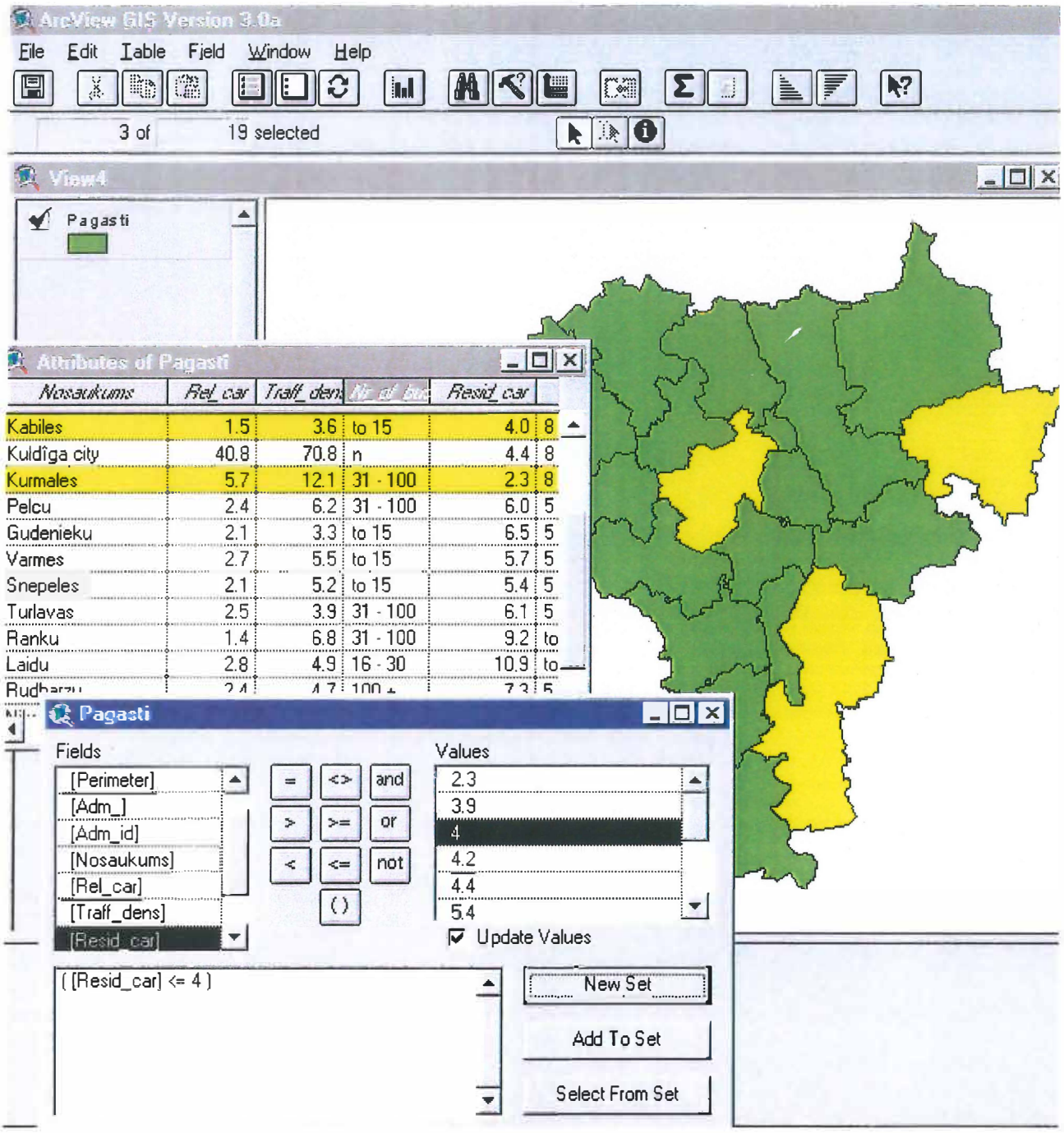
Re 4.1 Symbolising attribute data

The most common way to symbolise attribute data is to select colours to show the different values. The screen image below shows how the "Legend Editor" is used to illustrate the classification of the groundwater protection in Kuldiga district.



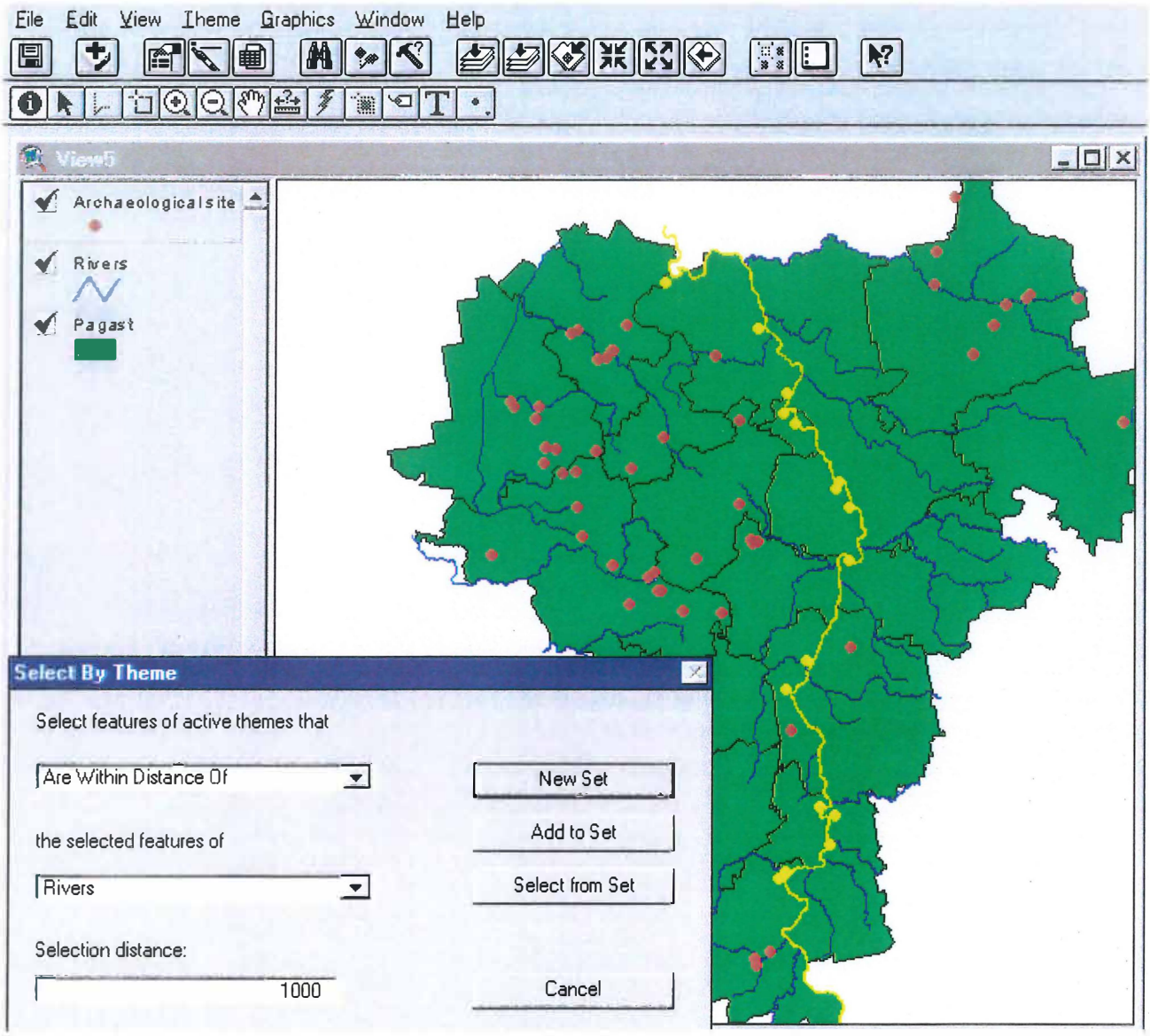
Re 5.1 Geographic analysis - Finding features with particular attributes

By using the "Query Builder" it is simple to find features with particular attributes.
The example here shows (in yellow) the pagasts in Kuldiga district with less than 4 persons per car. A window showing a part of the attribute table is on the left and the "Query Builder" window is below.



Re 5.2 Finding features near other features

This example shows how the "Select by Theme" facility is used to find all archaeological sites less than 1000 meter from Venta river in Kuldiga district.



4.2 Second GIS-training

The second GIS-training should have been based on 2-3 month experience with ArcView in the districts but only half of the participants got some experience before the next training sessions. These were held in September (week 37) and included more advanced facilities. To increase the outcome of the second GIS-training this was divided into two sessions, one with emphasis on GIS-analysis for the planning situation and another with emphasis on production and correction of new digital map themes. In the disposition below all tasks in 1, 2 and 3 were given to the *district planners* at the first training session and then the *"GIS-specialists"* dealt with task 1, most of 2, 3.6 and 4 at the second session.

The full disposition for the second course was as follows:

1. Basic introduction
1.1 Presentation of all participants incl. teachers
1.2 GIS-experiences before or since the first GIS-training
1.3 Plan for this second GIS-training
1.4 Data sources and the GIS-user network

2. GIS and Planning - recapitulation and new knowledge
2.1 Recapitulation on ArcView: Projects, views, scripts, layouts, themes, attribute tables, features, selectionsets....
2.2 ArcView Basic exercise (basemap handling)
2.3 How to use GIS for planning?
2.4 Planning exercise-1 (Making thematic maps)
2.5 Recapitulating data selections
2.6 Planning exercise-2 (Area conflicts)
2.7 Creation of new attributes and aggregating attributes
3. "New" GIS-applications for planning situations
3.1 How to combine information
3.2 Planning exercise-3 (Database joins)
3.3 Planning issue: Town development.
3.4 Planning exercise-4 (Overlay and visual evaluation)
3.5 Bufferzones and distances queries
3.6 Planning exercise-5 (Planning in residual areas)
3.7 GIS and planning in general - discussion
3.8 Making "nice" layouts (saving layout-templates)
3.9 Planning exercise-6 (Adding views and charts to a layout)
3.X Tuning data and systems (incl. indexing)

4. GIS-specialist tasks
4.1 Image handling
4.2 Specialist exercise-1 (adding an image to a view)
4.3 Digitising new themes (on-screen)
4.4 Specialist exercise-2 (creating new map themes)
4.5 Editing digital maps in ArcView (incl. limitations)
4.6 Specialist exercise-3 (editing themes)
4.7 Data import and conversion (geographical projections)
4.8 Specialist exercise-4
4.9 How to use predefined scripts (customising the userinterface)

Most of the exercises in the second GIS-training were demanding specific mapthemes for district planning. These did of course not exist for Latvian districts yet. We used instead some relevant mapthemes from Viborg county in Denmark and some other geo-data from GEUS.

Below some more examples to show the content of the GIS-training.

Re 2.6 Planning exercise-2: Area conflicts

In this exercise were used data from Viborg county to learn how to make basic analysis of area conflicts. The filenames are abbreviated Danish words:

Planning Exercise-2: Polluted areas and drinking water supply

Task: Investigate the potential conflicts between drinking water supply and polluted areas.

Purpose: To create an inventory (list) based on a geographical selection. (These kinds of calculations are a good base for political discussions).

Create a new view with:

- A_depot_point
- Vandbor_point
- Vandfsom_region
- Kom_region

Select all polluted sites inside water supply areas (Vandfsom_region) and make a list of them.

Select all water supply drillings (Vandbor_point) that are less than 370 m from a polluted site.

Question: Is any water supply drillings found inside the drinking water supply areas that are influenced by a polluted site ?

Calculate the total amount of water that potentially is influenced by polluted areas

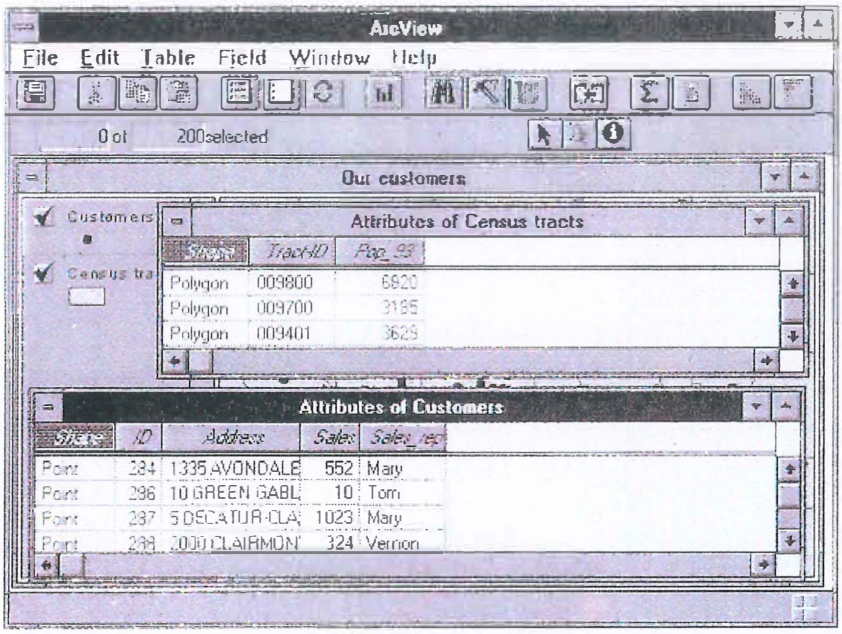
Calculate the amount of water in each object type that is influenced by polluted areas (in pseudo SQL: select "objekttype", sum (vandmængde) group by "objekttype")

Additional: Create a map showing the polluted sites in drinking water areas, the water supply drillings that are influenced by polluted areas and highlight the selected water supply drillings inside water supply areas (if there is any).

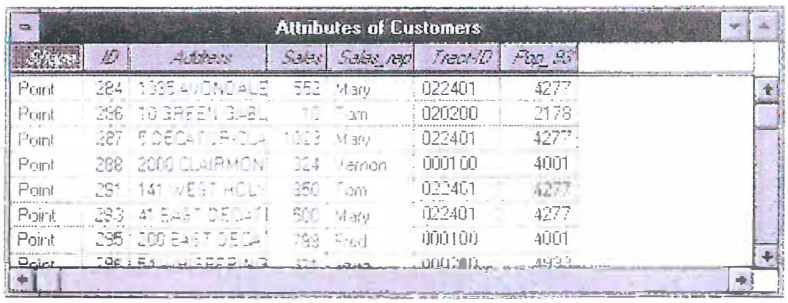
Re 2.7 Creation of new attributes and aggregating attributes

It is always possible to add new attributes to a maptheme by just typing in the values. Quite often however the need is to get new attributes by combinations and calculations upon attributes from several existing mapthemes. Below is shown a part of the explanation from "Using ArcView GIS".

2. Open the attribute table for the Customers theme in the same way and click on the Shape field.



3. Click the Join button. ArcView appends the attributes of the census tracts into the attribute table of the Customers theme, so that each customer record is given the attributes of the census tract that customer is located in.



Now you'll summarize this table to obtain the average sales per census tract. You'll summarize it on the Tract-ID field, the attribute that uniquely identifies the census tract each customer is located in. When you summarize a table, ArcView automatically creates a new table containing summary statistics derived from your table.

4. Click on the name of the field that you want to base the summary on, in this case, Tract-ID.

5. Click the Summarize button.

Re 3.2 Planning exercise-3: Joining database information

Training in combining database information was partly done by using geological maps and data from GEUS as in this example:

Planning Exercise-3: Joining soil type information

Task: Investigate the possibilities of supplying borehole information to a soil type map.

Purpose: To combine information from several tables and/or themes in different ways.

Make a new view consisting of:

- Djskov
- Soil
- Zeusshap

Select all boreholes (Zeusshap) in forest areas (Djskov) by a spatial join.

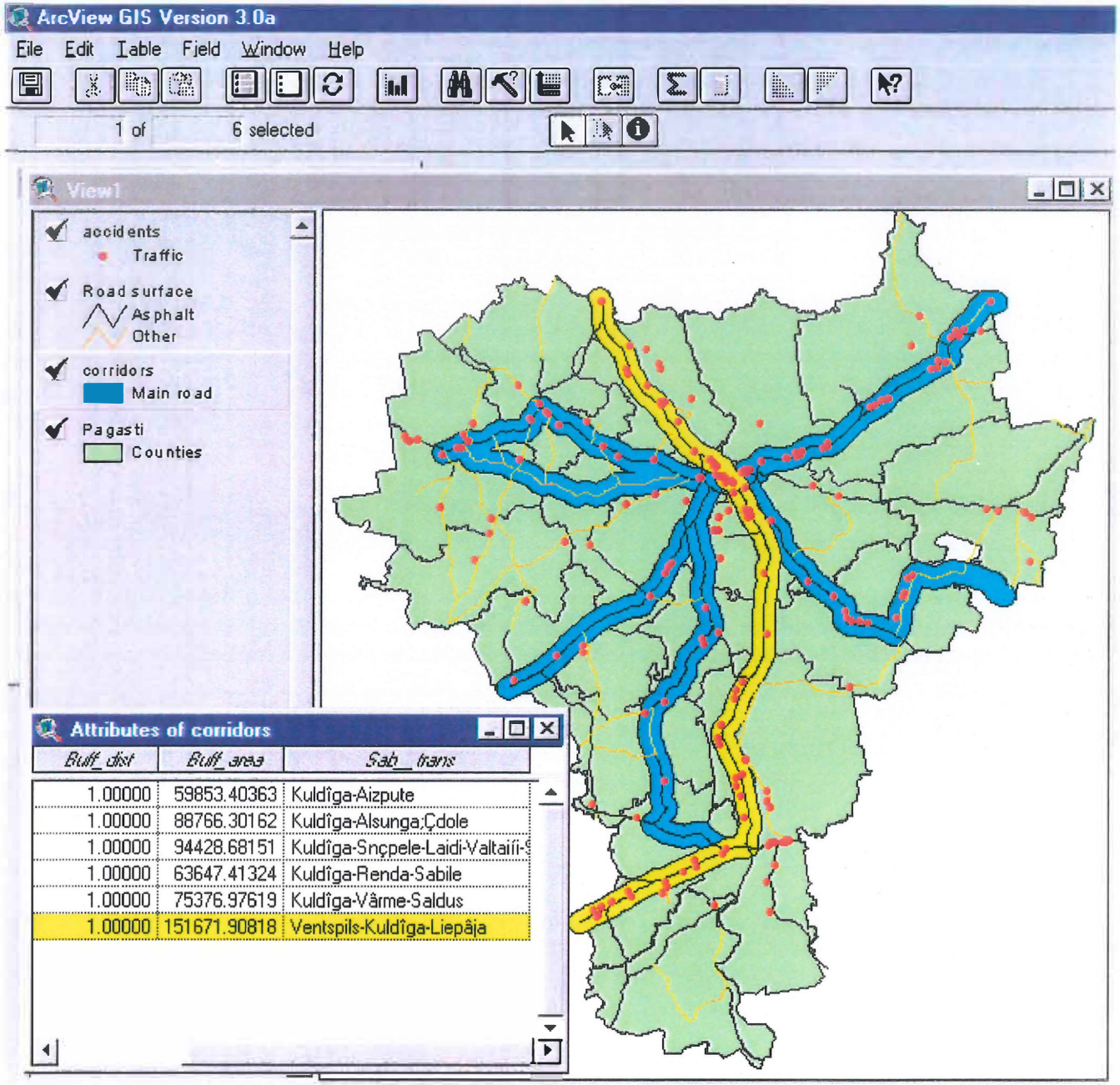
Question: How many of these are made in sandy soil (ES, DS, MS) ?

Open the table Zeuslit with geological information on the different layers in each drilling (borehole).

Link the Zeusshap information with the lithological information. Explain what happens. (To makes it less heavy to run on the computer. Select a part of the soilmap (Zeusshap) and convert it to a new shapefile, which you add to the view).

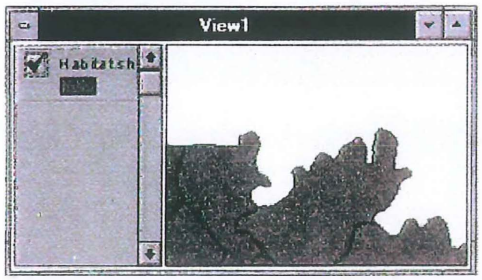
Re 3.5 Bufferzones and distance queries

By creating bufferzones like the 1 km bufferzone around the main roads as shown below many distance queries can be made i.e.: "How many of the traffic accidents in Kuldiga district could be related to the road Ventspils-Kuldîga-Liepâja?"



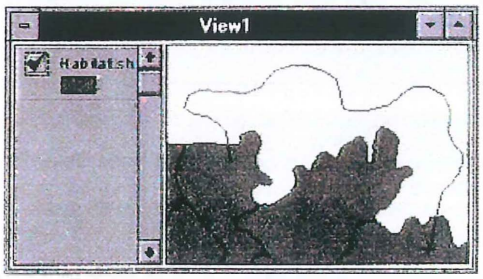
Re 4.4 Specialist exercise-2: Creating new map themes

New mapthemes can be made by digitising or by combining existing mapthemes. The digitising can be done "on-screen" or using a tablet (se page 14). Both methods uses the same ArcView commands, some of them are shown below.

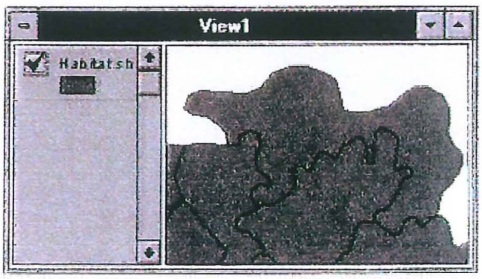


1. Click the Drawing tool palette and in the list of tools that pops down, click the AutoComplete tool. (If this tool is dimmed out, your theme is not currently in edit mode. Choose Start Editing from the Theme menu).

2. Draw a line that starts and stops at any of the existing polygon boundaries to enclose the area of the new polygon you are creating. To draw the line, click where you want the line to start, click each vertex along the line, then double-click the final vertex. When you draw the line, you can overshoot the existing polygon boundaries.



When you have finished drawing the line, ArcView automatically completes the new polygon, and removes any overshoots from the line you drew.



4.3 Follow up workshop 1998

This activity consisted of 3 days – two in Kuldiga and one in Riga. In Kuldiga we had one day for all districts (see disposition and distributed material below) and one day for participants from Kuldiga district only. In Riga all the participants from the state level were invited.

Disposition

- **History of the GIS-part of the project**
- **GIS-status in the districts**
- **GIS-status and future of the project**
- **New ArcView extensions - Analysis and Xtools** (How to install)
- **Content of new extensions**
- **Recapitulation on digitising and editing maps**
- **Typical errors while digitising or making analysis**
- **Databases - why use this tool**
- **Quality problems:**
    - **Accuracy**
    - **Completeness**
    - **Reliability**

Materials which were distributed to all districts:

- Xtools (papers and diskettes)
- Analysis (papers and diskettes)
- Register keys (paper)

The main issues of the one-day workshops were

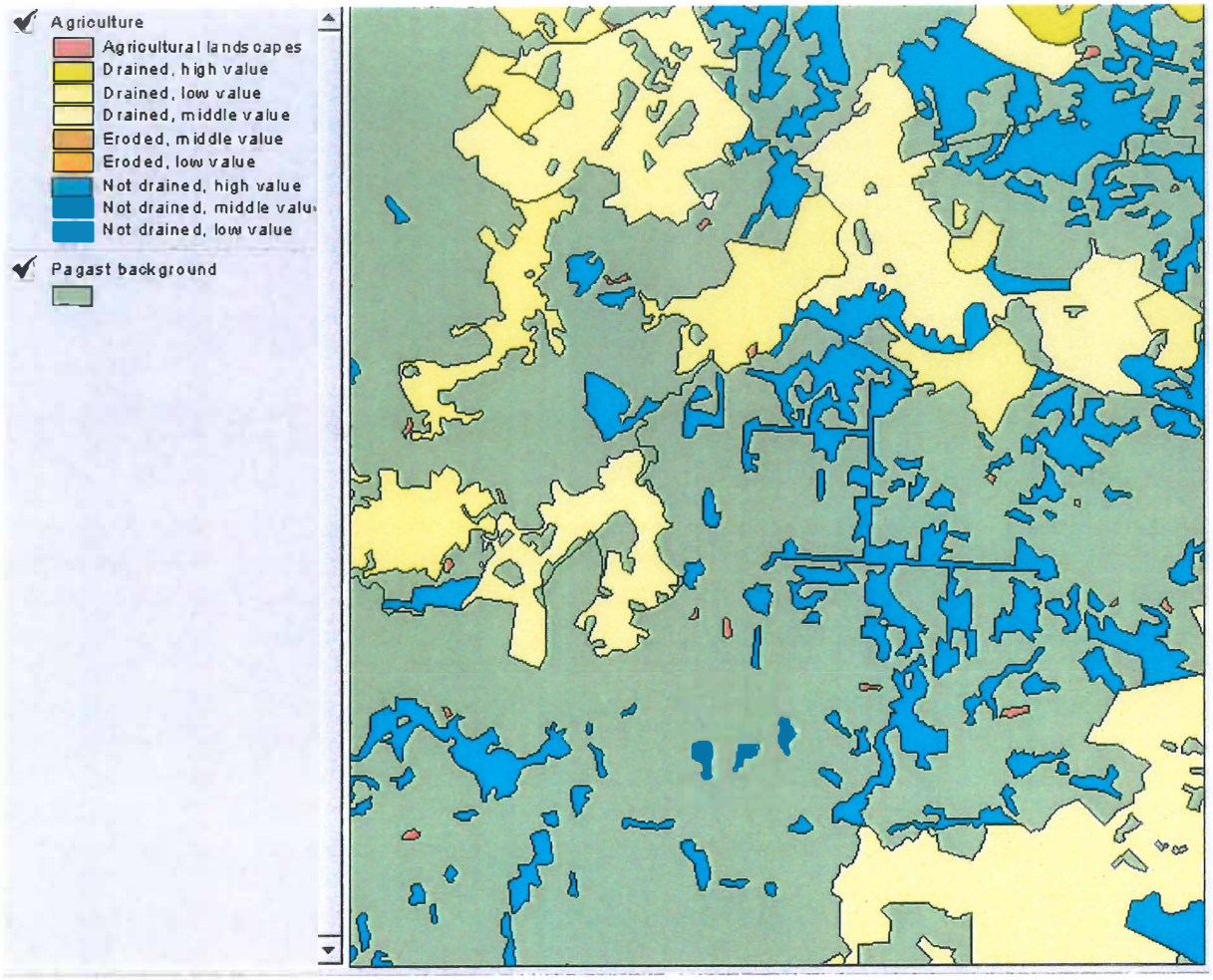
- Follow up of activities in 1997
- New possibilities in the new extensions
- Typical errors and how to avoid them
- Data quality

Examples of the discussion about errors and data quality follows on the next page.

Data quality and errors.

Though the agricultural maps are in a larger (more detailed) scale than most of the other maps, they might still be more erroneous than maps in smaller scale. Map quality and scale can not be compared. The more details the more possible errors.

The map below might contain errors inherited from the division of mapsheets. The odd rectangular formed "not drained"-polygon could be a mismatch along some mapsheet borders. This would be a very typical error which would require an "edgematching" (see page 14).



5. Experiences and how to use these in other districts

The introduction of GIS in the district planning in Latvia has just started and final recommendations can not be made. Based on the experiences in this pilot study the following issues could at this stage be highlighted for the future work:

- Relevant hardware must of course be available – this includes not only a powerful PC but also some sort of digitising table and plotter[1].

- The GIS software must be flexible, easy to use and include a lot of geographic analysing tools. ArcView and MapInfo are for the time being the more relevant GIS' and they both use dataformats which are quite common and make interchange of mapdata to other systems easy. ArcView - supplied with relevant extensions - is better in mapproduction and a little more powerful in geographic analysis – and it is close to a EU-standard for GIS[2]. But MapInfo is much stronger in handling input data in different geographic projections. – In Latvia projections seem to cause few problems thus all maps in this project have used UTM-coordinates in a special Latvian zone[3].

- The cooperation between state institutions (as the Geological Survey or the Forestry Department) and district planners is important. The Latvian districts are – in this stage of development – not able to produce all the relevant mapthemes by themself.

- The topographic maps must be available in relevant scales (1:50.000 – 1:200.000) and should be bought with full user rights within the district administration. Some of the mapobjects might not be relevant but this needs a further investigation. The more relevant mapobjects are those which perform the necessary frames for the planning mapthemes (district and pagast borders, rivers, roads etc.).

- When purchasing digital maps one should demand the most necessary attributes included and all mapobjects should have full topology. That means no dangling arcs, no erroneous intersections and all polygons must be closed. Errors that are found within few months from the data delivery should be corrected by the purchaser free of charge.

- The personnel who is going to use GIS – as planners or mapproducers – need to have some experience with computers as well as map handling before starting the actual GIS-

[1] Preferably larger than A3 format
[2] EU has chosen Arc/Info as their GIS-standard within environmental mapping

training. This training should give both a general understanding of GIS with emphasis on planning tasks and the ability to operate the actual GIS-programs. The training program should consist of 2 or 3 courses with time for practice at the local GIS-workingplace in between.

- To stimulate the use of more beneficial and sustainable GIS-functions in the districts a GIS-user network should be established among the GIS-users in a region. This could be done during a period of common GIS-training.

- Many of the interesting planning data (statistical data etc.) will soon have to be placed in databases. This will make it easier to combine with GIS, but the need for persons with database experience will then increase too. Thus database training will become more important in future planning projects.

- To take full advantages of GIS in district planning, the institutions should also build up an organisational frame for the GIS. (For instance a "GIS-unit" of 2-3 persons in the planning office). This would ensure stability in the local GIS-expertise and the updating of maps and databases which are vital for the ongoing planning process.

Final remarks

It seems to be possible to include the use of GIS in the Latvian district planning process without great difficulties. Hardware and software are easily accessible and digital basemaps will soon exist for all Latvian districts. Other planning relevant data might not exist in digital form yet but that is an obstacle to overcome if it is calculated into the plans from the beginning.

Concerning the persons to do the GIS-job, it seems to be like in many other European countries: Few persons with GIS-experience but quite a lot with the necessary background to learn GIS in short time. The major problem might be to withhold the expertise in the districts. For this reason – and many others – a good cooperation between the districts would be very valuable.

Whether the integration of GIS in the actual district planning process will be a success is hard to say at this stage. It depends on the understanding of the possibilities and limitations of the GIS-tool but of course even more on the success of district planning in Latvia itself.

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[3] This would lead to problems if the data should be combined with international data sets. Many old maps used instead an international Gauss-Krüger projection.